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INFORMATION FORESTRY

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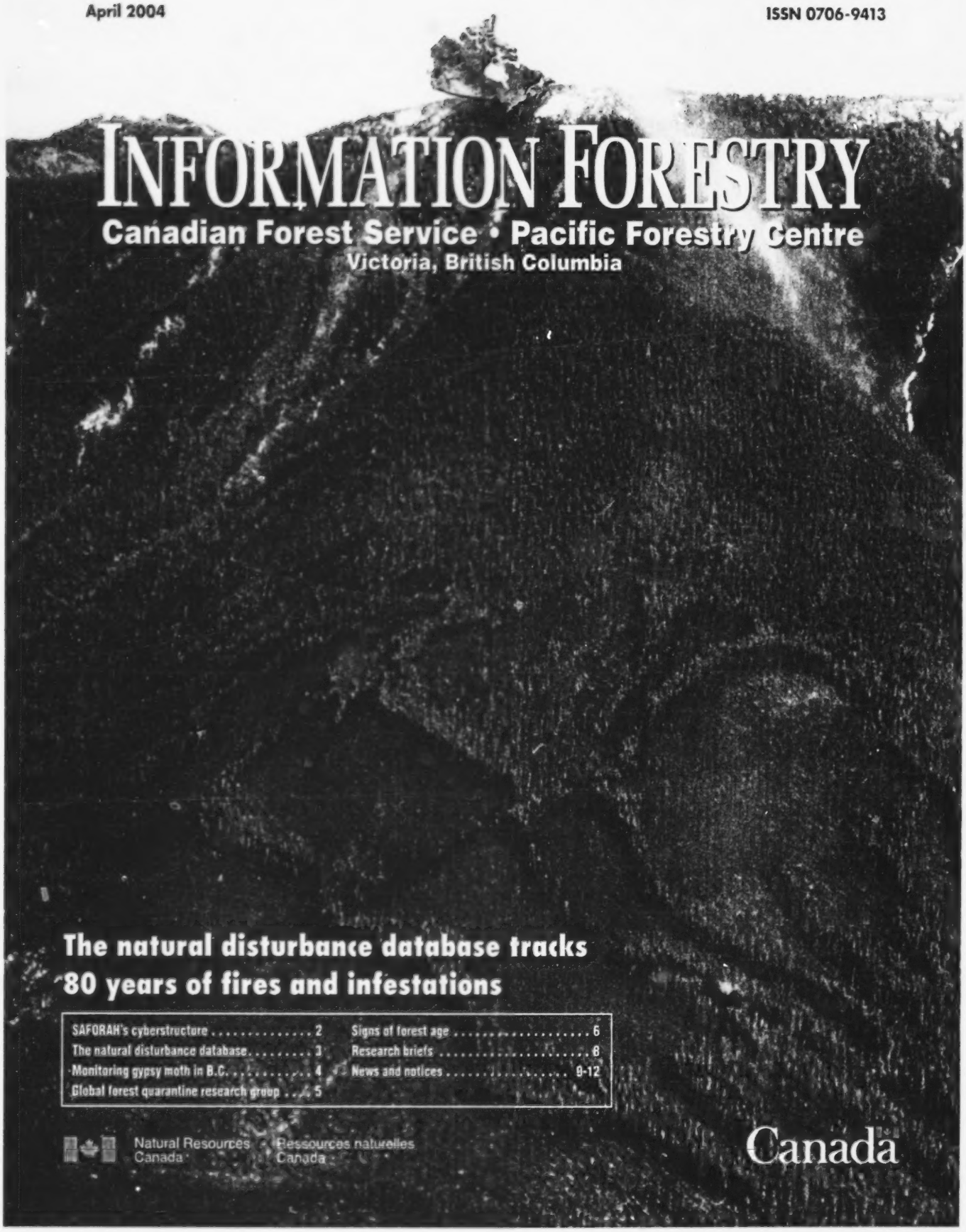

The natural disturbance database tracks 80 years of fires and infestations

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2007-03438/

Cross-Canada cyberstructure manages super-sized data

Time it takes to download a three-gigabyte image:

- using the Natural Resources Canada intranet network and the internet: 8 hours, 57 minutes
- using the SAFORAH GigE Grid and partner networks: less than 4 minutes

Forest researchers can now access an innovative, Canada-wide data-storage and management system for large-size digital images, a project initiated by the Canadian Forest Service and the University of Victoria. SAFORAH, or System of Agents for Forest Observation Research with Advanced Hierarchies, is a virtual-world networking infrastructure that catalogues, stores, distributes, manages, tracks, and protects the earth-observation images Canadian Forest Service retrieves from remote-sensing sources to measure such things as forest cover, forest health, and forest-carbon budgets.

When University of Victoria physics professor Randall Sobie suggested Canadian Forest Service Senior Research Scientist David Goodenough (**dgoodenough@pfc.cfs.nrcan.gc.ca**) join him in developing a storage system for large data, it seemed a simple solution to storage problems at the Pacific Forestry Centre. With more than 400 million hectares of forest covering Canada's landscape, Goodenough and his team had thousands of large digital images that needed to be stored, managed, and shared among researchers. Some of the images are as large as 40 gigabytes, or 40 billion bytes.

"One thing led to another," Goodenough says. "In solving our storage problem, the opportunity came up to design a system on a national scale."

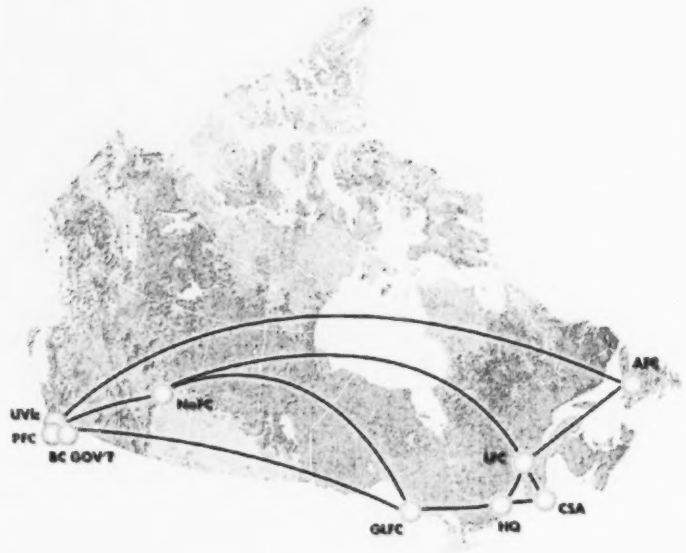
The collaborators set their sights on creating a grid of data-storage sites across the country, linked by high-speed networks. Project development included the university's supercomputer, the British Columbia government's Common Information Technology Services agency, the Canadian Space Agency, and five Canadian Forest Service centres.

A chain-reaction of partnerships transformed and augmented the project. The provincial government and the university provided technical support and broadband gigabit networking. The team obtained access to GLOBUS software, which integrates PC and UNIX operational systems. MacDonald, Dettwiler and Associates provided software to catalogue and manage the data. The team modified this to operate across the grid—telling users where any image is stored, who created it, and any other information about the data. By registering with the National Research Council's Grid Canada, SAFORAH protects its data and system, and enables higher-speed data transfer.

At the start of 2004, when demand for digital images created by the forestry centre was high, Graham Hicks, the technical architect with Common Information Technology Services who engineered SAFORAH's link to the province's high-speed network and helped develop the grid, assessed the data-transfer rate out of SAFORAH. "We measured wide-area internet traffic during the first week steady at 10 to 12 megabits per second from SAFORAH servers. Performance to and from grid end-systems at the university over the province's network showed in excess of 140 megabits per second. Image-transfer times were very acceptable, and confirmed the need for high-performance networks to support forestry research."

The SAFORAH team is now developing a way to use spare computer downtime to analyze digital images. "The Canadian Forest Service is a large organization with a lot of computers that are in use only seven, eight hours a day, five days a week," Goodenough says. "Computer-agent technology will enable us to take all the idle computers connected to our grid, download data, and use idle computer time to solve research problems."

Analysis of earth-observation images to solve forest-research problems could take place 24 hours a day, seven days a week.



Researchers and other users may apply for access to SAFORAH by registering at **www.saforah.org**

New database defines forest-disturbance patterns

A database developed by the Canadian Forest Service and the British Columbia Ministry of Forests will help researchers and planners predict the future by understanding the past. The Natural Disturbance Database digitally catalogues information from more than 15,000 wildfires and 300,000 insect infestations that occurred in British Columbia during the last 80 years. The compiled data makes it possible to recognize patterns and peer into the future.

"As we begin to understand what happened in the past with fire or infestation," says Pacific Forestry Centre Forestry Officer Steve Taylor (**staylor@pfc.cfs.nrcan.gc.ca**), who leads the project, "We can use that information to help us assess what may happen, in terms of probability of disturbance, size, and even its shape. We can better understand how disturbance risk is affected by weather, topography, and different forest characteristics, like forest composition and age."

Beginning in the 1920s, provincial officials maintained an atlas of wildfires larger than 20 hectares, and federal forestry officers mapped major infestations by insects such as mountain pine beetle and spruce budworm. Until this project brought it to light, much of the information was stored in offices and filing cabinets, and few people knew it existed.

The database's importance became clear last summer, when wildfire swept through the Kelowna area, burning thousands of hectares of forest, forcing 25,000 people to evacuate, and destroying hundreds of houses. "Everyone was surprised by the size of that fire," Taylor says. "But if we look at the map of historical fires, we can see that other fires just as large have occurred there again and again."

The data being made available will not only help municipalities and governments assess fire risk in places where forest meets suburbia, it will allow researchers to analyze how the range of mountain pine beetle, an insect infesting more than 4.2 million hectares of the province's forests, is changing, and whether fire risk increases in infested areas. The database will also help forest managers mimic effects of natural disturbances as companies try to manage forests more sustainably.

Forest managers will be able to use the information to refine timber-supply models. "Right now it's really difficult to estimate timber losses due to natural disturbances," says Taylor. "Current timber-supply models only inexactly account for these losses. The database will allow for a more quantitative approach."

"The power of this tool in developing a better understanding of disturbance and its relationship to other ecological processes has tremendous potential," says Bruce Blackwell, a consultant with BA Blackwell and Associates, of Vancouver, who used the database when he was assessing the long-term impacts of fire risk in the southern interior. "I expect the database will be invaluable in the assessment of factors other than fire, including forest health and risk assessment of important resource values."

Three years in the making, the database is undergoing testing and analysis by Taylor and his team. Elements of it are posted on the project website, with more and more being made available as analyses are completed. Within a year, everything will be available.

The Pacific Forestry Centre website features animated maps of areas affected by the province's 12 biggest natural disturbance agents. Visit **www.pfc.cfs.nrcan.gc.ca/fires/disturbance**

Photo credit: British Columbia Ministry of Forests

From the cover:
The Natural Disturbance Database contains information from thousands of fires, including the Ware Creek fire, which cleared a mountainside in northeastern British Columbia in the mid-1990s.

Older fire maps used to create the Natural Disturbance Database—such as this map of fires in the north Okanagan from 1920 to 1949— were drawn on linen-backed paper, and then watercoloured; fire maps made since 1950 consist of mylar overlays.

Scientists increase moth-monitoring effectiveness

Monitoring the moth

- Considered a serious forest and urban pest throughout eastern North America, gypsy moth usually arrives in British Columbia as egg clusters or pupal cases laid on vehicles, outdoor furniture, or other items that people move from infested areas.
- British Columbia is considered gypsy moth-free. The province's policy is to eradicate all introduced populations before they become established.
- The Canadian Food Inspection Agency, the federal agency responsible for regulating exotic pests in Canada, regularly monitors for gypsy moth in British Columbia.
- The Canadian Forest Service provides scientific advice on gypsy moth biology and pest eradication to British Columbia's Gypsy Moth Technical Advisory Committee.

Canadian Forest Service scientists played a vital role in defining management actions regarding recent gypsy-moth incursions into British Columbia. As members of the province's Gypsy Moth Technical Advisory Committee, researchers Lee Humble and Vince Nealis, both of the Pacific Forestry Centre, provide scientific advice on keeping the province gypsy-moth free. When European gypsy moths were found in traps in Saanich, north of Victoria, and in Delta, south of Vancouver, the scientists helped draft recommendations that led to enhanced monitoring, as well as plans for eradication programs.

Their goal was to determine whether the moths were part of growing infestations—which would warrant pesticide spraying—or were isolated strays that would die out on their own. The committee also wanted to determine, if these were infestations, what their limits were.

The first step was to intensify trapping. Pheromone-baited traps were set in almost every front and backyard.

"Standard placement for gypsy moth traps is one trap for every square mile," says Nealis (**vnealis@pfc.cfs.nrcan.gc.ca**). "That's a blunt, crude tool when you're trying to determine the limits of an infestation, especially if you're looking at urban areas or ecologically sensitive areas. The greater the trap density, the more refined our information is regarding the exact location of the moth and whether populations are increasing or decreasing."

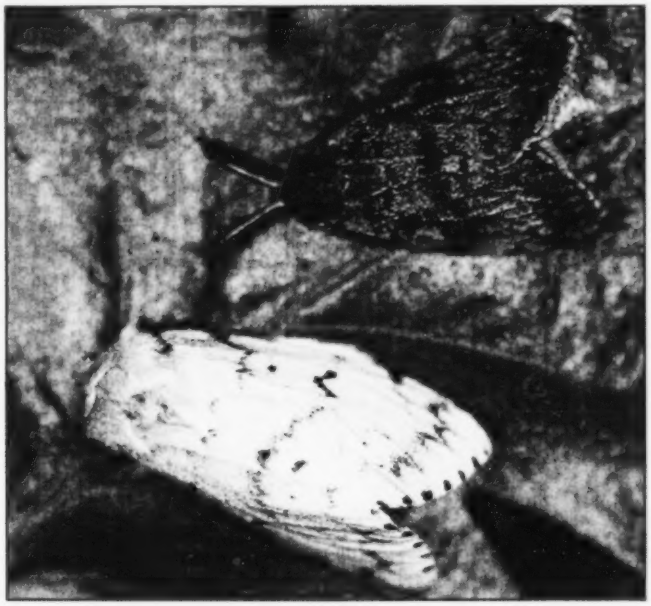
When the scientists first recommended increasing monitoring, they hoped mass trapping would not only define the area of infestation but also eradicate, or at least reduce, the moth populations by removing male moths from the population. "We were looking for an alternative treatment to controversial spray programs," says Peter Hall, forest entomologist with the British Columbia Ministry of Forests, and chairman of the advisory committee. "Although we did not accomplish that in either Delta or Saanich, the intensive trapping program allowed us to closely delineate the areas of concern, which helped us set very conservative spray boundaries."

Scientists identified 570 hectares in Saanich and 23 hectares in Delta that require spraying if the moth is to be eradicated. Without monitoring and analysis of results, either more hectares than necessary may have been slated for spraying, or significant portions of the infestation may have been missed.

"You could spray an area that turns out to be only the leading edge of an infestation," says Humble (**lhumble@pfc.cfs.nrcan.gc.ca**). "The main population could be kilometers away, and you could miss it entirely. Which means you have to spray again the next year."

The pesticide sprayed to eliminate gypsy moth is called BTk (*Bacillus thuringiensis* var. *kurstaki*), a biological insecticide that must be eaten by caterpillars to be effective. Studies show it is harmless to most other animals, and breaks down when exposed to sunlight.

More information about gypsy moth and Canadian Forest Service entomological research can be reviewed at **www.pfc.cfs.nrcan.gc.ca/entomology**



Gypsy moths are partial to more than 500 host species of broadleaved trees and shrubs. Asian gypsy moths (brown male and white female shown here) also eat conifers.

Research group tackles global forest-pest problem

Gypsy moth, chestnut blight, white pine blister rust, Dutch elm disease ... these insects and pathogens came to Canada during the last century and made themselves at home in our forests. Too much at home! With comfortable conditions, little competition, and no natural enemies, they reproduced and spread, indelibly changing Canadian forest and woodland landscapes.

More forest pests and diseases gain entry into Canada's forests every year. During the last few decades, global trade has increased exponentially, as has the speed at which goods can be moved from one part of the world to another: plants, insects, and forest pathogens can now cross oceans as easily and as quickly as people and severe acute respiratory syndrome do. Often the pests stow away aboard trade goods—wooden packing material such as cable spools, crates, and timber braces provide ample hideouts for trans-oceanic-travelling organisms. Asian longhorned beetle, emerald ash borer, and brown spruce longhorn beetle—tree-killing insects invading woodlands and urban landscapes in southern Ontario and Atlantic Canada—are believed to have arrived in North America among packing materials shipped from Asia.

A new international research organization is working to stop this globalization of forest diseases and pests. The International Forestry Quarantine Research Group, which held its inaugural meeting in Rome in February, brings together more than 40 scientists and plant-protection officials from around the world to discuss forest quarantine-related problems of global significance. As scientific advisors to the International Plant Protection Convention, the group will identify global forestry and quarantine research needs and undertake collaborative research to support development of international standards.

"The aim of the group is to coordinate international research and focus efforts, knowledge, and skills to address plant-quarantine problems that affect forests worldwide," says the group's chair, Eric Allen (**eallen@pfc.cfs.nrcan.gc.ca**), a research scientist at the Canadian Forest Service's Pacific Forestry Centre. "By working together on these problems, we can be more efficient and, in the end, have greater impact."

And by working closely with regulatory officials, the research group will provide the science needed to support development of global phytosanitary measures that safeguard forests and trade. Under the World Trade Organization – Sanitary and Phytosanitary (WTO-SPS) agreement, plant-protection regulations must be based on sound scientific data. If they aren't, the measures may be challenged, and trade may be disrupted.

Photo credit: Robert A. Haack, USDA Forest Service, www.invasive.org

Asian longhorned beetles escaped from untreated wooden packing materials delivered to a north-Toronto warehouse seven or eight years ago to reproduce among the city's maples, birches, willows, and other broadleaved trees. Intensive monitoring and eradication programs are in effect to rid the area of the tree-killing insect.

The issue of most immediacy and concern that the group is tackling addresses the recently adopted international wood packaging standard, ISPM #15. The research group is refining treatments approved to eradicate pests within wood-packaging materials, and developing guidelines for the submission of proposed new treatments under ISPM #15. Newly formed expert subcommittees are also evaluating treatment alternatives.

Endorsed by the Interim Commission on Phytosanitary Measures and linked to plant-protection organizations through the United Nations Food and Agriculture Organization, the group is affiliated with the International Union of Forest Research Organizations' new working group, Alien Invasive Species in International Trade (7.03.12), which brings together the broader forest science community to deal with forest-quarantine issues.

For more information or to become a member of the International Forest Quarantine Research Group, visit **www.forestry-quarantine.org**

Signs of age in Vancouver Island Douglas-fir forests –

Each of the four Coastal Forests Chronosequence Project sites on southeastern Vancouver Island contained plots of regenerating forest, immature forest, mature forest, and old-growth forest. This old-growth plot, located in the city of Victoria's reservoir watershed, has since been harvested to enlarge the reservoir.

Forest managers implementing ecosystem-based forest practices would do well to search the woods for arboreal lichens, Indian pipe and candy stripe, and certain species of fungi and carabid beetles. According to Canadian Forest Service Research Scientist Tony Trofymow, these often-overlooked forest residents tend to inhabit old-growth forests. Their presence can indicate how successful sustainable forest management practices are in maintaining biodiversity and mimicking natural forest processes.

"We found some potential, non-structural attributes of old-growth stands that have recovered in second growth, and some that haven't," says Trofymow (**ttrofymow@pfc.cfs.nrcan.gc.ca**), of the Canadian Forest Service's Coastal Forest Chronosequence project. "The species and processes that haven't recovered are what sustainable forest management schemes should focus on, if indeed a company's aim is to maintain biodiversity within a stand. Recovery of those species and processes, or lack thereof, provides a measure of how successful a company's efforts are."

Trofymow is one of dozens of scientists who monitored and analyzed four forest sites on southeastern Vancouver Island from 1992 to 1998. Each site contained stands that formed a post-harvest age-group series of regenerating forest, immature forest, and mature forest, as well as a control stand of old-growth forest older than 240 years. These chronosequences allowed researchers to track patterns of post-harvest succession among southeastern Vancouver Island's dry, Douglas-fir-dominated coastal forests without waiting the 200 or more years it takes for a harvested stand to develop into old-growth forest.

Scientists measured and compared structural attributes such as overstorey-tree size, canopy gaps and abundance of snags, biodiversity characteristics such as diversity and abundance of insects, plants, lichens and fungi, and processes such as soil chemistry and carbon-stock change. Their findings resulted in more than 60 research papers, which Trofymow and colleagues synthesized into refined definitions of old-growth and post-harvest successional Douglas-fir forests on Vancouver Island.

"There are critical structural attributes of old-growth forests—tree size, tree density, abundance of snags and deadfall, type of canopy—which remain part of the definition of old growth. Then there are those particular organisms that we monitored that should be included in the definition: organisms with limited dispersal capabilities and ranges—organisms that call that patch of forest their home."

Pattern of post-harvest succession

The synthesis also confirmed that succession in coastal forests after harvest differs from that in forests that have burned. When Trofymow and his colleagues compared the pattern of change in the chronosequences with that developed for a post-fire succession model for Douglas-fir forests in the Pacific Northwest, they found few of the structural, biodiversity or process attributes followed the post-fire pattern of recovery. Many attributes recovered more rapidly after harvest. How a stand is

- chronosequence research identifies biological indicators

disturbed seems to affect how it recovers: harvested stands have fewer snags and less downed wood than burned stands, while replanting speeds crown closure and overstorey growth.

"You could say, 'Of course tree growth is going to be more rapid with silviculture,'" Trofymow says. "But now we have data that shows the same for other attributes."

He warns more data is needed to make the model reliable. It is unclear whether, if left undisturbed, the harvested stands will follow the successional pathways implied by the chronosequence, and develop into stands that resemble the project's old-growth controls. Factors such as site geography or quality may shift the perceived pattern of development.

"What we came up with is only an approximation of what the pattern is: it's incomplete and only partly formed. If we could follow the stands for 100 years, and remeasure every decade or so, we would really know the pattern of succession."

Putting research into practice

Weyerhaeuser provided access to two sites with complete chronosequences and one mature stand at a third site. Now the forest company is using the chronosequence research results to plan and monitor a ecosystem-based forest-management scheme the company began implementing in its coastal timberlands in the late 1990s, now called the Coast Forest Strategy. The new style of management includes a harvesting approach called variable retention, which leaves dispersed trees or patches of forest throughout a cut area. These serve as lifeboats and seed-sources for organisms requiring older, more-established trees and forest while harvested portions regenerate and recover.

Because so little post-harvest research on non-structural attributes exists, Glen Dunsworth, genecologist with Weyerhaeuser's British Columbia Coastal Group, says the company has developed a research and monitoring program to evaluate the effectiveness of the forest survey. This program relies in part on the chronosequence project for information on non-structural attributes of post-harvest succession.

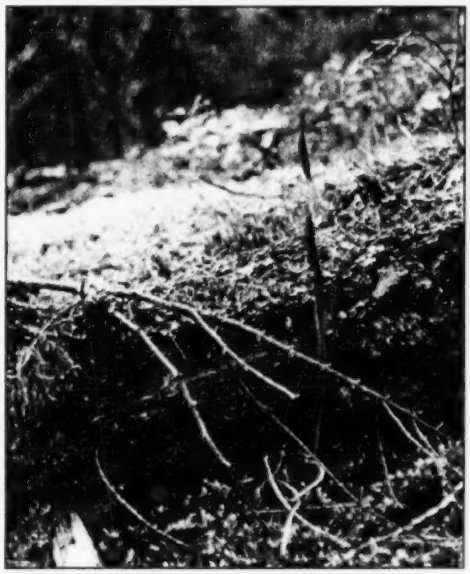
"The Coastal Forest Chronosequence Project follows stands at various ages in development, which is really unusual. Variable retention is so new, no established, harvested conditions exist where we can look at the different kinds of attributes and see how they change through time—that can tell us what we can expect to see on our own lands."

Identification and use of old-growth controls in the chronosequence study is key. "So few old-growth stands on the island remain," says Dunsworth. "These controls allow us to compare the effects of our adaptive management and monitoring program with unaltered old-growth ecosystems."

In 1998, Weyerhaeuser set aside the old-growth chronosequence plots on its land to use as benchmarks against which to compare recovery among the company's variably harvested areas. Foresters and biologists measure forest attributes before and after harvest. The data is used to plan harvest regimes that retain stands' key features, such as rare plants, creeks, or rock outcrops. As stands regenerate, managers can measure rate and degree of biodiversity recovery against data from pre-harvest conditions, on-site retained patches, and old-growth controls.

Information on the Coastal Forests Chronosequence Project is available at **www.pfc.cfs.nrcan.ca/ecology/chrono**

For information on how Weyerhaeuser is putting the chronosequence findings into practice, contact **glen.dunsworth@weyerhaeuser.com**



Biological indicators of a forest's age include achlorophyllus plants such as candy stripe—found in old-growth forest.

Signs of age in a Douglas-fir forest

Some attributes differed significantly in old-growth stands and may serve as indicators of old-growth:

- Tree and snag size
- Arboreal lichen abundance
- Achlorophyllus plants such as candy stick (*Allotropa virgata*) and Indian pipe (*Monotropa uniflora*)
- Certain fungi (*Russula xermapalina*)
- Certain carabid beetles (*Zacotus matthewsii* and *Carabus taedatus*)

Research Briefs

Mistletoe subspecies makes the coast home

Canadian Forest Service researchers recently established that a mistletoe that infects shore pine on Vancouver Island and the Sunshine Coast of British Columbia is its own subspecies.

"We'd suspected for a number of years that this was the case," says Ed Wass (**ewass@pfc.cfs.nrcan.gc.ca**), the Pacific Forestry Centre research technician who led the project to reclassify shore pine dwarf mistletoe as a subspecies of western hemlock dwarf mistletoe. "But we didn't have enough data to confirm it."

For two summers, Wass and colleagues hiked the province's south coast, defining the parasitic plant's range, establishing field plots, and collecting samples. They determined the subspecies is found only along the coast, from Orcas Island, in the Strait of Juan de Fuca, to Maurelle Island, at the north end of Georgia Strait. Analyses show the subspecies is smaller than other kinds of western hemlock dwarf mistletoe, and has larger flowers and berries. It is also consistently green-brown in colour, unlike related mistletoes, which range from yellow-green to purple.

Wass says the reclassification has implications for forest management. "With the move to variable-retention silviculture, it is important to know the susceptibility of the tree host to different dwarf mistletoes. On infested sites, trees retained or planted should be immune or have low susceptibility."

An accurate classification will also help scientists develop host-specific biological controls of the parasite. According to the British Columbia Ministry of Forests, infection by western hemlock dwarf mistletoe may reduce growth by as much as two million cubic metres every year in the province's coastal western hemlock zone.

Shore pine dwarf mistletoe is always green-brown in colour.

Sunscreen for spruce

Increased sunlight doesn't always mean increased tree productivity. In a study examining growth limitations in Engelmann spruce, Canadian Forest Service scientists exposed seedlings to different light and nitrogen levels to determine how the two interact. Instead of increasing growth when exposed to intense light, the trees tanned.

Many plants respond to too much light by increasing red and yellow pigmentation in their leaves. According to Pacific Forestry Centre Research Scientist Al Mitchell (**amitchell@pfc.cfs.nrcan.gc.ca**), one of the researchers who conducted the study, the response indicates stress.

"There are two steps to photosynthesis: harvesting light energy, and using light energy to fix carbon. When plants are subjected to intense light, extreme cold, or insufficient water or nutrients, the two processes become unbalanced."

The greater the imbalance, the greater the stress; the greater the stress, the greater the change in pigmentation. Mitchell found when he exposed seedlings to intense light, they too protected themselves against burning by increasing production of red and yellow pigments. The shift helps the seedlings convert excess light energy into heat, which then dissipates.

According to the study, protoprotection, not increased growth, characterized the response of Engelmann spruce to high light. This seems to occur even when water and nutrients are plentiful.

"By measuring pigmentation, we may be able to measure stress and thereby infer productivity," says Mitchell. "If we worked out a way to sense pigmentation levels remotely, it could be an early warning system for stress at the stand or landscape level."

News and Notices

Beetle research receives additional $1 million

Natural Resources Canada has approved another $1.1 million in funds to research British Columbia's mountain pine beetle epidemic. That's in addition to more than $4 million in research projects approved in spring 2003.

"Years of study tell us this attack is unlikely to be stopped without a very cold winter. This is why we're investing in research—to deal with the impacts of this current epidemic and to reduce the risks of future epidemics," says Canadian Forest Service, Pacific Forestry Centre Director General Paul Addison.

The money comes from Natural Resource Canada's Mountain Pine Beetle Initiative—a five-year $40 million program announced last year to battle the beetle. Funds from the program also assist private landowners and First Nations to control and rehabilitate beetle-infested land. Money approved to date has helped industry, universities, private researchers, provincial and federal departments research a variety of topics including wildfire risk, management strategies, beetle biology, and markets and products for beetle-attacked wood.

More information on the Mountain Pine Beetle Initiative is available at **mpb.cfs.nrcan.gc.ca**

A tree tries to flush beetles out with pitch.

Beetle attracts big crowds

Mountain Pine Beetle devastation

For more information on mountain pine beetle and the Canadian Forest Service's role in beetle research, visit **www.pfc.cfs.nrcan.gc.ca/entomology/mpb**

With 4.2 million hectares of British Columbia's forests infested by mountain pine beetle in 2003, the lodgepole pine boring insect is on the minds of many people throughout the province. More than 250 forest professionals, scientists, First Nations and community representatives from across western North America met in Kelowna, British Columbia, in October to discuss the epidemic and what can be done about it.

Held in conjunction with the Entomological Society of Canada's annual meeting, the British Columbia Entomological Society hosted a one-day mountain pine beetle forum, "Challenges and Solutions". The forum allowed participants to share the latest research, practices, and recommendations for monitoring and containing the beetle. Half of those attending work in British Columbia's forest industry.

"It's an indication of the impacts and the level of concern caused by the epidemic," says Canadian Forest Service Forest Entomology Research Scientist Dr. Terry Shore (**tshore@pfc.cfs.nrcan.gc.ca**), who helped organize the workshop. "These people are the first to see beetle damage in the forests and are the first affected."

The immensity of the outbreak was emphasized by Larry Pedersen, Chief Forester for British Columbia, who announced at the forum provincial estimates for the total infestation area will more than double in 2003 and are expected to have increased sharply again by next summer. Only severe, prolonged cold temperatures or a surprise cold-snap in the spring or fall will contain the epidemic. Even then, the outbreak's impacts will continue: according to Pedersen, after 15 years the total allowable timber cut will fall by about 19 percent in severely affected areas because of the outbreak. In addition, the number of trees killed by the beetle will long affect fire management, climate-change carbon accounts, and markets for British Columbia wood.

Demand for information about the beetle epidemic is so high Canadian Forest Service scientists are scheduling a beetle forum for the spring in Prince George, in the heart of the infestation.

Proceedings from the Kelowna forum, published by the Canadian Forest Service, will be available for distribution later in 2004.

News and Notices

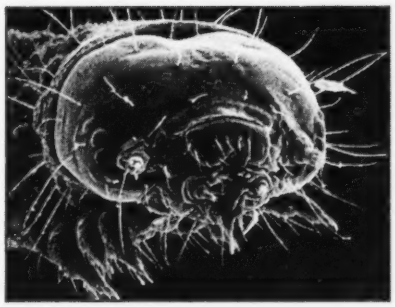
Forestry centre research displayed

It was a community partnership with big exposure for the Canadian Forest Service and some of British Columbia's smallest residents. When the Royal British Columbia Museum organized its winter exhibit, Giant Robotic Insects, the Pacific Forestry Centre volunteered materials, services, and information about its research. Approximately 100,000 museum visitors viewed the centre's 100x life-size mountain pine beetle model and the six giant portraits of tiny mites, spiders, fruit flies and mosquitoes taken with the centre's scanning electron microscope. The contributions were displayed alongside specimens from the museum's insect collections and the six-metre-long, mechanical robotic insects made by the Japanese robotic-exhibit design and engineering group, Kokoro Company.

"When we host traveling exhibitions such as Giant Robotic Insects, we really work to augment them with material relevant and timely to British Columbia," says Rob Cannings, curator of entomology at the museum, and curator of the exhibit. "The objects, illustrations and the scanning electron micrographs from the Pacific Forestry Centre add to the exhibit—enhancing its effect and impact, and helping tell British Columbia stories."

The exhibit featured two areas of Canadian Forest Service research: the Montane Alternative Silvicultural Systems' canopy-dwelling-insect project, conducted on southern Vancouver Island, and mountain pine beetle, which is devastating central British Columbia forests.

Giant Robotic Insects ran at the Royal British Columbia Museum from November through March.



The Royal British Columbia Museum's Giant Robotic Insects exhibit provided new perspectives on little bugs this winter. Pacific Forestry Centre Head of Microtechnique Services Lesley Manning and Microtechnique Technician Terry Holmes scanned this spruce budworm larva for the exhibit using the centre's scanning electron microscope.

Scientists partner with non-timber centre

For years, Canadian Forest Service scientists have worked with communities throughout British Columbia to help develop economically and ecologically sustainable non-timber forest industries. Now, the forestry centre is collaborating on these goals with the Centre for Non-Timber Resources, an educational and research centre at Victoria's Royal Roads University. Launched in January, the new centre is geared to helping communities benefit from the sustainable use of non-timber resources, such as wild mushrooms, salal, and other products found among the forest understorey.

"This is a fabulous opportunity for us to be involved in helping rural and First Nations communities develop forest-based industry in ecologically sustainable ways," says Canandian Forest Service, Pacific Forestry Centre Director General Paul Addison. "Our scientists have a tremendous store of scientific knowledge about how forest systems work, and we want to make that available to these communities."

The Canadian Forest Service estimates wild mushrooms, salal, and other Canadian non-timber products in demand as forest foods, floral greens, craft materials, landscaping plants, and habitat restoration are worth $1 billion annually—much of which would directly benefit the rural communities engaged in harvesting them.

Sources...

For more information on research featured in this issue, search the Canadian Forest Service Online Bookstore, **bookstore.cfs.nrcan.gc.ca**, for these journal articles:

A New Subspecies of *Arceuthobium tsugense* (Viscaceae) from British Columbia and Washington

Photoprotection, not increased growth, characterizes the response of Engelmann spruce (*Picea engelmannii*) seedlings ....

Attributes and indicators of old-growth and successional Douglas-fir forests...

Additional titles to look for:

Stand structure and species composition in chronosequences of forests...

Abundance, species diversity, and community structure of Collembola ...

People

Accolades

The past year brought recognition to Pacific Forestry Centre Senior Research Scientist Imre Otvos for his research into biological control and integrated pest management. China's National Forestry Administration awarded Otvos a certificate of honour, proclaiming him a Research Professor of the country's Key Laboratory of Forest Protection, the Entomological Society of British Columbia recognized his contributions to entomology and the society with an Honorary Life Membership, and the Royal Entomological Society of London (UK) made him a Fellow. In addition, the Hungarian Academy of Sciences inducted him, and his Pacific Forestry Centre colleague Les Safranyik, into its membership.

Arrivals

David Harrison joined the Pacific Forestry Centre in February. As Chief of Mountain Pine Beetle Initiative Implementation, Harrison will monitor and report on the financial end of the various aspects of the initiative, and their contents and results. He brings more than 20 years of experience in managing business systems for science and technology with Canadian Forest Products Ltd., in Vancouver.

Departures

Evelynne Wrangler is leaving the Pacific Forestry Centre to return to Edmonton, Alberta. In the 30 months Wrangler directed the centre's Forest Information Division, she was active in the development of the Forest Carbon Accounting Framework that uses the Canadian Forest Service's carbon-accounting research, the development and delivery of infrastructure and services for the National Forest Information System, and the implementation of the National Forest Inventory. Evelynne's work in Victoria was part of an Interchange Canada program with the Alberta government. In Edmonton, Wrangler will again be working with the Alberta Department of Sustainable Resource Development.

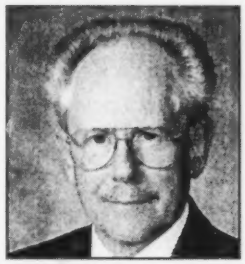
After 38 years of research with the Canadian Forest Service, Pacific Forestry Centre Research Scientist Duncan Morrison announced his retirement this spring. Morrison contributed significantly to forest pathology research, especially in relation to the distribution and biology of fungi causing conifer-root diseases and to the development of control procedures for such diseases. In addition to his research, Morrison was involved in the development and implementation of guidelines for management of tree hazards.

Memorials

Former Pacific Forestry Centre Director General Carl Winget passed away in November after battling cancer. During the nearly 40 years he worked with the Canadian Forest Service and Laval University, Winget made significant contributions to Canadian and international forest research. Pacific Forestry Centre colleagues fondly remember Dr. Wing-nut, the mad-cap, mad-scientist character Winget created to lighten staff meetings and popularize forest research.

Winget is survived by his wife, children, and grandchildren, as well as generations of forest researchers who worked with him and were influenced by his passion for science, his kind nature and his humour.

Imre Otvos



Duncan Morrison

Carl Winget, as Dr. Wing-nut

Comings Events

Variable Retention Forestry Science Forum

Malaspina University-College Forestry Extension Program
April 21–22, 2004, Nanaimo, B.C.
Information: www.mala.bc.ca/www/ForestEx/VarRetention

Canada's Forests—A Fine Balance

National Forest Week Seminars and Workshops
May 2-8, 2004, Pacific Forestry Centre, Victoria, B.C.
Information: www.pfc.cfs.nrcan.gc.ca

Forest Expo 2004

Prince George Regional Forest Exhibition Society
June 3–5, 2004, Prince George, British Columbia
Information: www.forestexpo.bc.ca

Restoration on the Edge

International Conference on Ecological Restoration
Society for Ecological Restoration International, Canadian Land Reclamation Association,
and Technical and Research Committee on Reclamation.
August 23–27, 2004, University of Victoria, Victoria, BC
Information: www.serbc.info

One Forest Under Two Flags

Joint 2004 AGM and Convention
The Canadian Institute of Forestry and the
Society of American Foresters
October 2–6, 2004, Edmonton, Alberta
Information: Teresa Stokes - **Teresa.Stokes@gov.ab.ca** or **www.cif-ifc.org/meet**

New from the bookstore

First Nations Forestry Program, British Columbia 2003–2008. Guidelines and Application 2004-2005. 2003. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, B.C., Indian Affairs and Northern Development Canada.

Information Forestry, December 2003. Keiran, M., editor. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, B.C.

Monitoring Canada's Landcover from Space (poster) (le suivi de la couverture terrestre du Canada à partir de l'éspace). 2003. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, B.C.

A technique for mapping the impact of mountain pine beetle. 2004. Wulder, M.A.; Franklin, S.E.; Skakun, R.S.; Dymond, C.C. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, B.C. Technology Transfer Note 32.

Technique de cartographie de l'impact du dendroctone du pin ponderosa. 2004. Wulder, M.A.; Franklin, S.E.; Skakun, R.S.; Dymond, C.C. Ressources naturelles Canada, Service canadien des forêts, Centre de recherches forestières du Pacifique, Victoria, C-B. Note de transfert technologique 32f. 4 p.

Old-growth forests in Canada (poster-pamphlet) (Les forêts anciennes au Canada). 2003.

Recent publications–Winter 2003. (Publications récentes - hiver 2003). 2003. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia.

Gestion et répression de l'ajonc d'Europe et du genêt à balai en Colombie-Britannique. 2004. Prasad, R.P. Ressources naturelles Canada, Service canadien des forêts, Centre de recherches forestières du Pacifique, Victoria, C-B. Note de transfert technologique 30f. 6 p.

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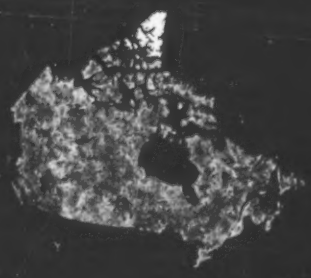

Canada: a mosaic
and,
Green aliens invade